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ABSTRACT

The Second Law of Thermodynamics demonstrates the idea of entropy, the tendency of ordered energy to free itself and thus break apart the system that contains it and dissipate that system into chaos. When applied to communications theory, entropy increases not only with noise but with the density of information--particles of possible meaning crowded into a channel at too high a rate for the receiver's decoding ability. Entropy is lowered by redundancies (familiar information) which allow the receiver to anticipate and thus comprehend what will be said next. Entropy is a metaphor in physics and chemistry and a metaphor built on a metaphor in communications theory, where the idea of noise substitutes for the unavailable energy, which is then calculated mathematically and not measured empirically. By examining the idea of entropy, rhetorical theorists can avoid the particular limitations analogical thought tends to establish and explore qualitatively the factors that tend to disorder and to order in rhetorical systems. (RB)

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ENTROPY IN RHETORIC

by

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". . . I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto . . . expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: Have you read a work of Shakespeare's?"

In his pique at the arrogant humanists in Two Cultures, C. P. Snow is ironically pertinent. If humanistic study has purpose it surely concerns the ordering or harmonizing of human society; yet the humanist, Snow implies, is unconscious of a concept that is at the heart of order. The Second Law of Thermodynamics is a mighty modification of the first, which as everyone knows tells us that energy can neither be created nor destroyed. The Second Law renders the idea of entropy, the tendency of ordered energy to free itself, and thus break apart the system that contains it and dissipate that system into chaos. It is known by the heat lost when a machine or any other system performs work. It has been defined as the random movement of molecules, the measure of unusuable energy or lost energy in a system, a measure of a system to do work, a system's tendency to disorder. The idea fits neatly Eliade's mythical concept of the eternal return, the tendency to original chaos.

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Some physicits are prone to limit their discussion of entropy to mathematical terms. Entropy of a system equals the heat flow in or out of a component (delta Q) divided by the Kelvin temperature of the component (T). Once you say more you are on shaky grounds. The arrogance and ignorance of Snow's humanists are nicely balanced in such physicists. Shaky ground indeed. Hamlet's world out of joint.

Entropy is a creation of mind stimulated by the human need for order, and to confine it to mathematical formulation because words are ambiguous is to reinforce its unrecognized persistence in our thoughts and feelings.

In thermodynamics, they call efforts to reduce the entropy of a system -- that is to make it more orderly -- an unnatural process; and an unnatural process, they tell us, is always accompanied by a natural process. Or in terms of entropy, a decrease in entropy in the unnatural act is at least equalled by an increase of entropy elsewhere. Energy forced to create order in one place is taken from another place, reducing the order there. The processes of nature compensate for the processes of mankind, which means that the tendency of the universe is always towards the human conception of disorder, which we naturally abhor.

Shroedinger, the biological philosopher states, "Life feeds on negative entropy," which is to say all living things are in a constant struggle against disorder, they fight continuously against chaos. And according to thermodynamic philosophers, the fight is ultimately futile. The term entropic doom was a popular way of putting it some time ago. The term referred to the sad fact that the unavailable energy in a thermodynamic

system is released to the universe at large and can never be recaptured. Thus, systems at work are forever destroying themselves, and so the expanding universe is gradually reclaiming its ordered parts. Entropic doom in human terms would apply to the increasing inability of free individuals to relate or respond, to maintain a system we can loosely call civilization or more benignly, society. Since the tribes and the tight and tiny polis of the Greeks, we have been gradually coming apart, isolating one from the other, tending to chaos in the universe of human life. Hamlet was a rare isolato in the very ordered society of Elsinore Castle compared to the isolatos displayed by Hawthorne and Melville. Samuel Beckett and other absurdists give very strong evidence that the rate at which entropic doom approaches has increased geometrically in this century. Or one can observe the tendency more casually in the current news sources of Britain and the United States. Political democracies are by nature highly entropic systems allowing degrees of freedom that are controlled in totalitarian systems, which tend to lower entropy.

I have no doubt that some social theorist is at this very moment working out a quantitative measure of entropy for societies, based on the amount of freedom enjoyed or suffered by its components (institutions) and bits (people). One easily perceives how the entropic idea can lead to new theories of social decay and revolution. Henry Adams, in fact, approached the concept in his theory of social disintegration. In communications theory, the concept of entropy is already well-established. Entropy is the measure of randomness in the information, which is a neat application of the thermodynamic definition of entropy as a measure of

the random motion of molecules. Meaning, in communication theory, is the ordering of information transmitted through a medium or channel. All bits of information in the channel or medium which are not received as meaning become noise. If the receiver of the information has a high degree of freedom in selecting its meaning, then the entropy is high, which means the information is largely noise; it is unshaped, disorganized. Entropy increases not only with noise but with density of information, particles of possible meaning crowded into a channel at too high a rate for the receiver's decoding ability.

Entropy is lowered, on the other hand, by redundancies, which allow the receiver to anticipate and thus make meaningful what will be said next. The more redundancy in a system, the more tolerance for noise. This theory obviously involves a good deal of counting and it may be of value in communications that aim at absolute denotation, as in mathematical language. But even in the report, a genre of discourse forever fighting the connotative nature of language, there is usually the shaping of reason, a process involving generalizations, abstractions, complex turns of thought. Even if these qualities could be counted, their values would change in each use; all subordinations, for instance, would not be equal. And unreasoned, uninterpreted, the accumulated bits of information, the data reported, are sheer noise for most everyone except those who have gathered it. (Our information explosion was aptly named.)

The failure to recognize entropy as invented calculation rather than physical measurement, has limited its meaning in communication theory to the concept of noise, the heat energy of the system, its sound

and fury. In such channeling all the magnificent possibilities for understanding rhetorical order and disorder, are attenuated. The way to meaning is not numerical. I would assume such an assertion as axiomatic at this late date in human history, but I am apparently wrong and so I stress the obvious point that entropy is something gotten up, it is a metaphor in physics and chemistry and a metaphor upon a metaphor in communications theory, where the idea of noise substitutes for the unavailable energy in a physical system, which is mathematically calculated, not emperically measured, and is then taken to represent the tendency to disorder in that system. It appears that communications theory takes its metaphor from analogy with electronic systems where the random motion of electrons in conductors, transistors and the like are indicators of disorder. Here the tendency to high entropy is apparently bad and its reduction is good. Perhaps rhetorical theory can avoid the particular limitations analogical thought tends to establish and explore qualitatively the factors that tend to disorder and to order in rhetorical systems, all with gratitude and appreciation for the communications theorists who have led the way.

If the attempt to apply the concept of entropy to communications theory appears fanciful, then the application intended here -- to rhetorical theory -- may seem to hover on the brink of absurdity. But there is precedent in the popular 18th Century rhetoric of Hugh Blair. He speaks of the relationship in a piece of rhetoric between the familiar and the strange. The proportions of these two factors in report, story, lyric, or what you will -- the proportion or perhaps we may say

ratio of the familiar to the strange determines the degree of order in the system.

Blair does not talk about systems, as do the theorists in communications. The available information in a communications system consists of redundancies (the familiar) and new information (the strange). A high degree of redundancy counters or perhaps accommodates the new bits of information -- I should say the rate at which the reader is given new items of information, but I would prefer Blair's idea of the strange, since it is more rhetorical; it accounts for types and degrees of audience ability to read or understand, so that highly abstract words, or far-reaching metaphor is included along with the concept being rendered to the reader. It includes whatever is unfamiliar. But Blair's idea of the strange, even though it is more inclusive than the idea of new information in communication theory, is still insufficient for an understanding of entropy in rhetoric. In addition to a high density of diverse content and of abstract language, there is at least one more factor that works against the reader's ability to recreate the writer's meaning.

The additional factor is the density of relationships, such as ambiguities, coordinations, subordinations, modifications, and degrees of digression which would include associative processes, non-sequitors and other alogical juxtapositions. For rhetorical systems, therefore, we may say that entropy increases with the unfamiliarity of content, the levels of abstraction and ambiguity, and the density of relationships. Let us say it another way: as the density of these factors increases in a rhetorical presentation, the difficulty of perceiving the meaning or the

order increases. And yet another way: the tendency to disorder, that is to meaninglessness, increases with increases in the rate of new information, rate of abstractness and ambiguity of language, and rate at which relationships are made. In those three versions of the same idea, density is the rate at which the reader is confronted by these factors in the rhetorical presentation.

In three different ways I have just repeated the statement of factors that increase entropy. It was not for emphasis, as some may say, but to reduce the tendency of my own presentation to disorder, to meaninglessness or high entropy, because I fear that I am dealing in unfamiliar ideas and using too many abstractions and perhaps involving too many involved relationships. Redundancy works to reduce the entropy by rendering the unfamiliar familiar, by giving recognizable shape to ideas and observations, and by applying abstractions to known particulars. The rhythm, rhyme, assonance and alliteration of poetry are redunding devices that render what is fresh and new. The use of motif and symbol in fiction as well as poetry are easily recognized devices of redundancy. Character is established by a variety of fundamental redundancies which set the type for the emergence of individuating surprises. Dominate moods and atmosphere also result from fundamental redundancies. Myth in all literature is a device that redunds with echoes through the centuries of civilization. Definition is a redundancy for the term defined; analysis is a redundancy for the subject under investigation; description is a redundancy for the thing described. The idea of rendering is the idea of redunding as opposed to

stating or telling. So is the idea of explaining, with its various ways of saying one thing and of summarizing.

Noise, which is defined as meaningless information and taken as the measure of entropy in communication systems, accrues on both sides of the entropic ratio when applied to rhetorical systems. Circumlocutions and clichés and excessive summary and the rendition of the obvious as in childrens' stories or some television documentaries turn off the attention of a mature audience. They are all noise. So are new items of information that remain unfamiliar, and dense series of abstractions. These factors become noise on either side of the entropic ratio because they frustrate and ultimately tire a reader who is always seeking meaning. Noise does increase the tendency to disorder but we cannot make it fit neatly into a definition for entropy unless we define two kinds or redundancy, meaningless and meaningful. Let us settle this troublesome detail by recognizing the obvious -- that excessive redundancy for a particular audience level tends to become noise just as unfathomable information is noise.

For rhetorical systems we can recognize noise as annoyance and therefore include in it not only a rhetor's disregard for a particular audience capacity and his copious use of empty locutions, but also his spellings, awkwardness and violations of anticipated grammatical constructions.

Like redundancies, relationships can also become noise -- meaningless combinations of information. Yet the very point of relationship is to create meaning. Lists of contents are shaped by

relationships such as prediction, coordination, subordination, modification. But a high density of these relationships without reinforcement create instead of meaning another list of contents, each item a kind of meaningless complex of words.

Abstraction and ambiguity also share this dual nature of both raising and lowering the entropy of a rhetorical system. Abstractions are generalizations that organize detail; intended ambiguities are statements about the complex possibilities of meaning in a situation. They are, in other words, relationships in themselves and function as do all other relationships to establish meaning. Like the others, they too become noise when presented in excessive density or rates.

Perhaps we can employ the single term "complexity" to represent all these factors in their tendency to increase the entropy or disorder of a rhetorical system; we can then employ the term redundancy to these same factors when they tend to lower the entropy or establish higher degrees of order. It becomes possible then to represent all the factors in a simple equation telling at once how the factors work to lower or raise entropy:

$$\text{Entropy equals } \frac{\text{meaningful complexity and noise}}{\text{meaningful redundancy}}$$

Although we can phrase such an equation, the application of numerical values would be disastrous. Entropy is a tendency and its value in rhetorical systems must be felt, not calculated. High or low levels differ for each reader or viewer, according to educational and

emotional development and interests. A book that reads as though it should have been an article has low entropy for that reader and a reader who thinks a particular article really needs the length of a book for comprehension is experiencing the quality of high, perhaps too high, entropy. I suppose it is inevitable that someone someday will establish entropic norms for readers and set about quantifying the quality of entropy. It is too tempting to ignore. But its value would be reduced to its current usefulness in communications theory.

We have accounted for the relationships of factors that determine entropy, but what is its value? I believe that it promises to yield a better description of the nature of rhetorical activity than we have had before, leading to more cogent means of analyzing a piece of rhetoric, of evaluating established work and of shaping the work at hand. It may also show how the human's unique feature -- the rhetorical ability -- corresponds with larger universal principles of natural processes. For example, at the highest level of entropy, at the point of total disorder of chaos or meaninglessness, we also have total equilibrium. Everything is equal. There is no emphasis, no shape, no force. This equilibrium has to be disturbed to make order, to shape meaning or transfer energy from one place or thing to another. The writer or rhetor disturbs the stagnation by shaping chaotic elements into systems of meaning. But this lowering of entropy, which allows the transference of meaning from one person to another, can continue beyond a point of profit, so that the meaning itself is redunding endlessly and thus becomes meaningless;

cliched patriotic gore, for instance. At excessible levels of redundancy, we have restored an equilibrium, the absolute zero of meaning. Perhaps we can see in this abstract example, that stasis occurs at both extremes of entropy. Meaningfulness occurs in the vital middle. The higher the entropy the fresher and more dynamic a work will tend to be. But at very high levels, as in Finnegan's Wake, the writer approached chaos, as Joyce recognized in his use of the term Chaosmos. The lower the entropy the duller and more static the work will tend to be, as in any elementary school text, or the cops and robbers chases and shootups on television. We can point to the factors in these works that make for the tendency to high and low entropy, which will give us greater understanding of our literary milieu. But even more important, in a most pratical way, we can employ our understanding of these factors to control -- to reduce or heighten -- our entropic levels in day to day discourse as our purposes require.